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Entitled

*SELECTION OF NATURAL SURFACTANTS FOR POSSIBLE USE IN IMPROVING OIL
RECOVERY OF CARBONATE OIL RESERVOIRS*

BY

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Abstract

Middle East petroleum industry is currently searching for the most suitable enhanced oil technique to improve the oil recovery from local oil reservoirs. The biggest challenge for the application of enhanced oil recovery (EOR) in the Middle East is the harsh environment (high salinity and temperature). Surfactant (synthetic or natural) is one of the enhanced oil recovery (EOR) major players considered for application in the Middle East. However, synthetic surfactants have several drawbacks, such as being economically unattractive and their high levels of toxicity. This study investigated the possible use of natural surfactant extracted from the leaves of three types of plants, namely Aloe Vera, Tetraena qatarensis, and Soapnut in a harsh carbonate reservoir environment. The efficiency of the extracted surfactants was assessed through various laboratory experiments, including interfacial tension (IFT) measurement, contact angle measurement, emulsion tests, and core flooding experiments. The present study follows the static and dynamic experimental work of the combination of the selected three natural surfactants at different concentrations with formation brine (232,000 ppm), seawater (50,000 ppm), and low salinity water (5000 ppm). Interfacial tension and contact angle measurements were measured to assess the effect of water salinity on interfacial activity and system wettability. Core flooding experiments of the optimum systems with lowest IFT and salinity of 232,000 ppm at high pressure (1100 psia) and temperature above 90°C were also performed to evaluate the selected natural surfactant oil recovery under dynamic conditions. Experimental results show that the Soapnut surfactant solution (18%) and Aloe Vera (10%) made with formation brine reduced the IFT from 25 dyne/cm to 0.9 dyne/cm and 0.5 dyne/cm, respectively. The oil recovery factor by of formation water, Aloe Vera surfactant-FW, and Soapnut surfactant-FW flooding was 15, 93, and 94.1%, respectively. It indicates that the Soapnut natural surfactant at a relatively low concentration is capable of working effectively in a harsh environment and was able to remove almost all the oil in place.

Keywords: Natural surfactant, Interfacial tension, Formation water, Core Flooding, Carbonate reservoir, Oil recovery factor.